Massachusetts Institute of Technology

Charles Stark Draper Laboratory

Luminary Memorandum #169

TO: Distribution
FROM: H. McOuat
DATE: 1 September 1970
SUBJECT: Effect of LSPOS "Bum Skinny" in Luminary-1D

An approximate position vector of the moon is computed in LSPOS. The unit vector is made up as:

RMOON (x) = COS (LOM)
RMOON (y) = K1 SIN (LOM) -K2 SIN (LOM-LON)
RMOON (z) = K3 SIN (LOM) +K4 SIN (LOM-LON)

The value of LOM is calculated as $LOM = LOM_0 + \dot{LOM}\ T$

$-(A \sin(W_A T + \phi_A) + B \sin(W_B T + \phi_B))$. (1)

The value of W_B was inadvertently mis-scaled in Luminary-1D by a factor of 2. The computed value is (W_B (correct) /2).

The first graph (coded 3 in the lower left corner) shows the Moon position error when things are going good. ABS(EMAX) < 1.1 DEG.

The second graph (coded 4 in lower left corner) shows the Moon position error as calculated in Luminary-1D. ABS(EMAX) < 3.3 DEG.

No fix is planned for Apollo 14. The ground can transmit a very accurate Moon position vector if that body should be desired for alignment.

For Apollo 15 the numbers must be changed since the interval of usage for LSPOS is one year (July 1.0 to July 1.0). The present data expires on July 1.0, 1971.

MIT/DL has made a long (4 year +) ephemeris tape and LSPOS values can be fitted for up to 4 years. The first run indicates a 1500 day fit with corrections made as in equation (1), has ABS(EMAX) < 1.9 degrees.

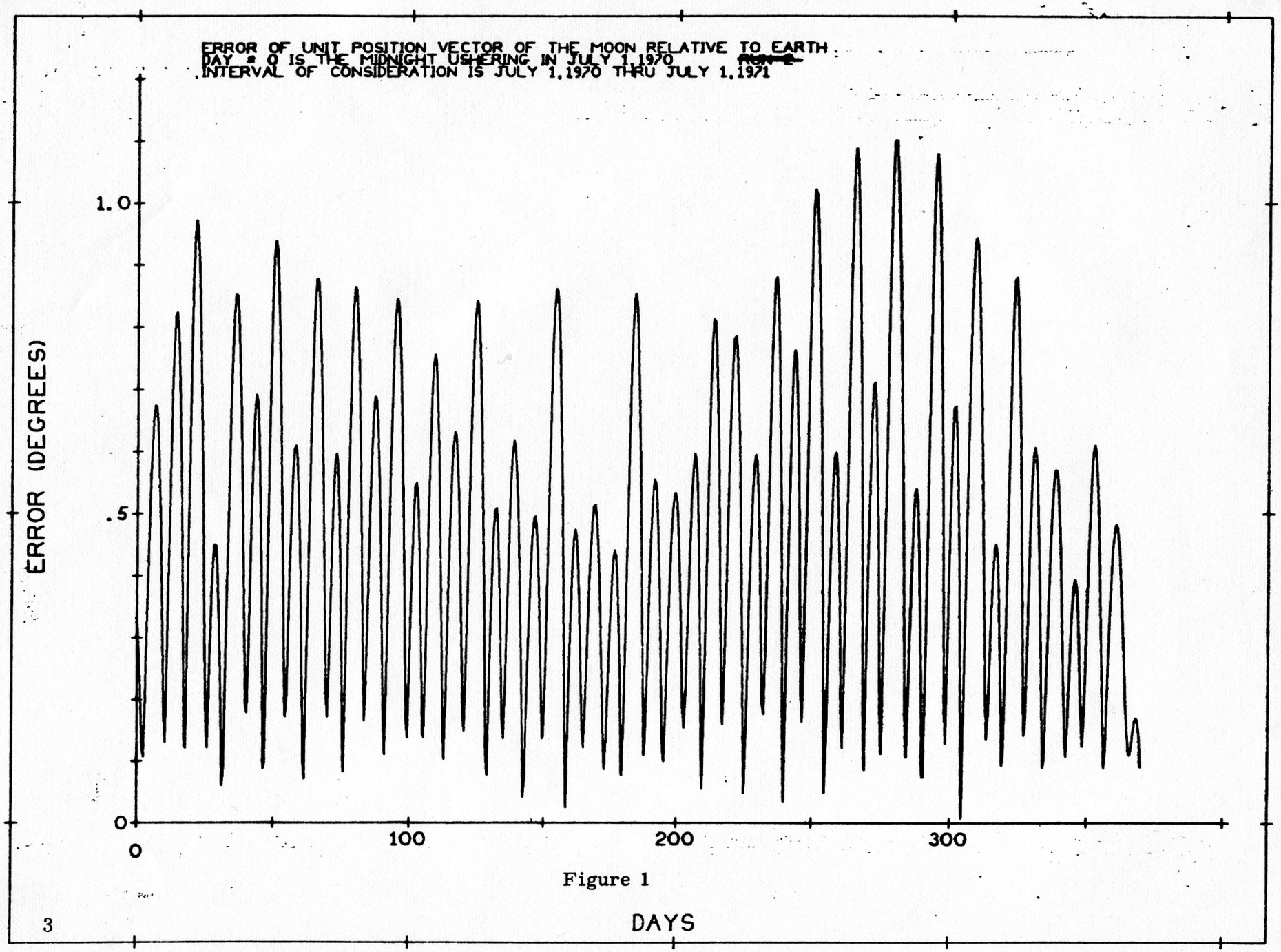
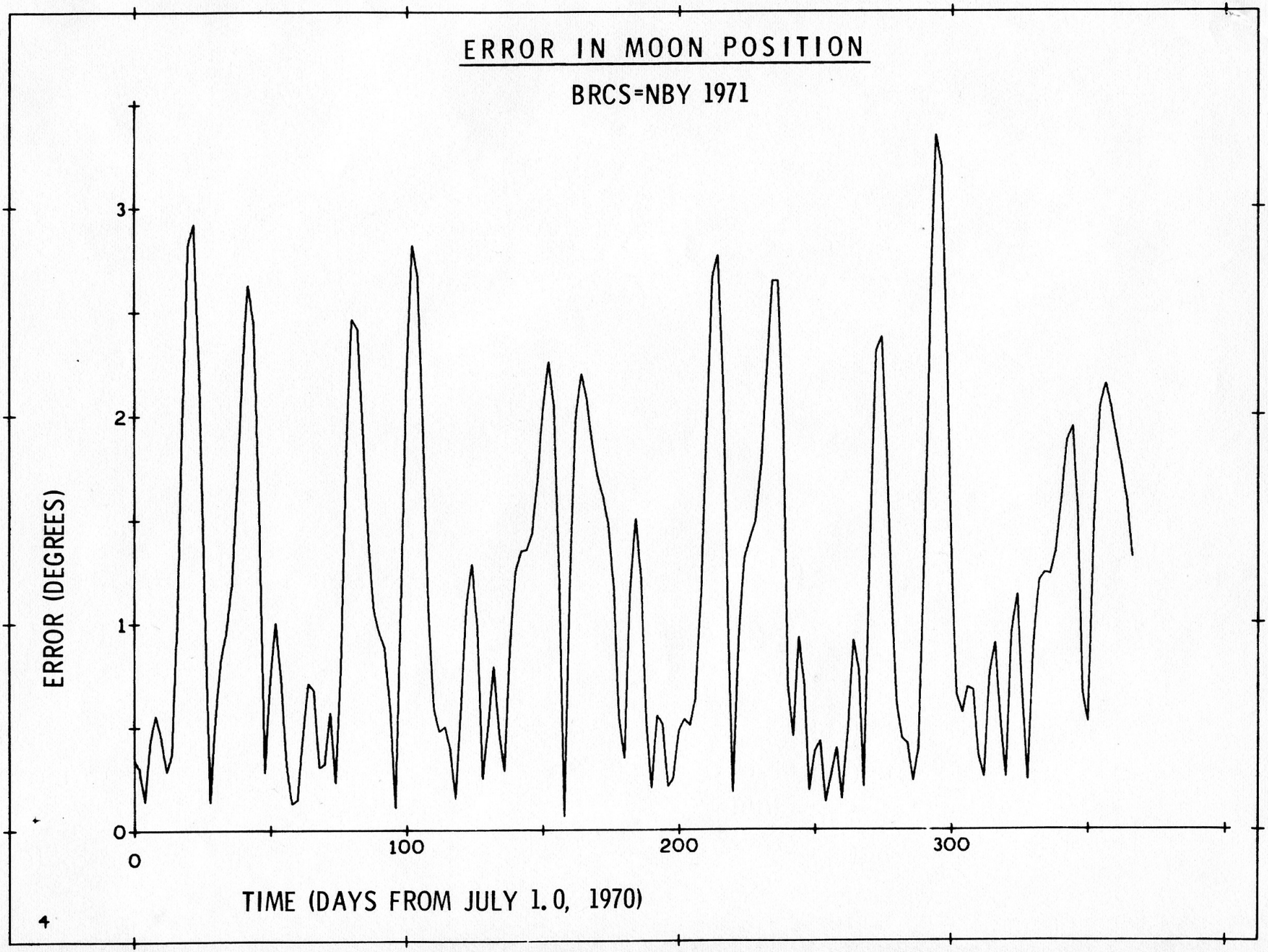
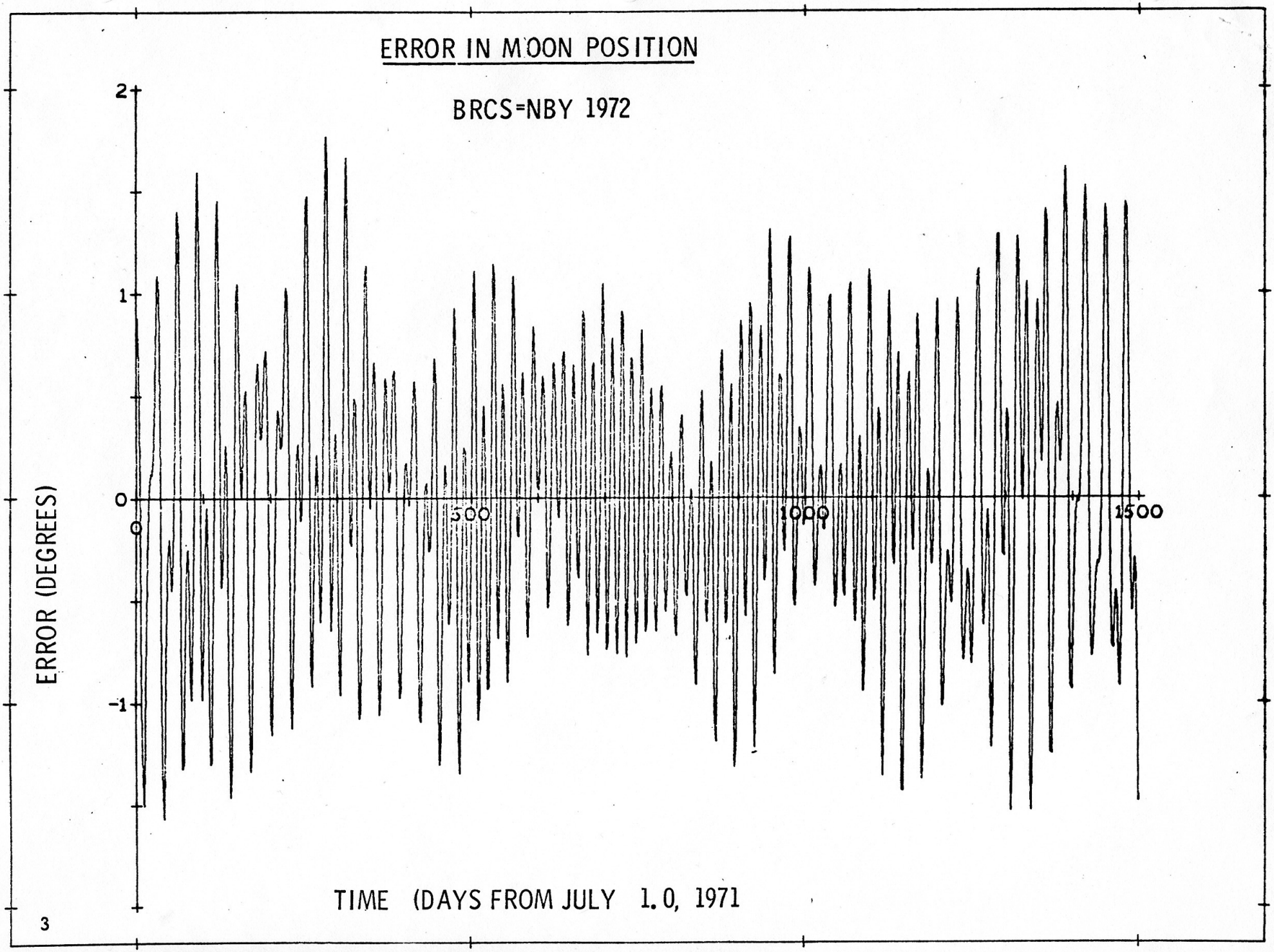

ERROR OF UNIT POSITION VECTOR OF THE MOON RELATIVE TO EARTH
DAY # 0 IS THE MIDNIGHT USHERING IN JULY 1,1970
INTERVAL OF CONSIDERATION IS JULY 1,1970 THRU JULY 1,1971
ERROR (DEGREES)
1.0
.5
0
0
100
200
300
DAYS

Figure 1


ERROR IN MOON POSITION
BRCS=NBY 1971
ERROR (DEGREES)
0
1
2
3
0
100
200
300
TIME (DAYS FROM JULY 1.0, 1970)


ERROR IN MOON POSITION
BRCS=NBY 1972
2
1
0
-1
0
500
1000
1500
ERROR (DEGREES)
TIME (DAYS FROM JULY 1.0, 1971